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Auditory stimuli mimicking ambient sounds drive temporal "delta-brushes" in premature infants

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Abstract

In the premature infant, somatosensory and visual stimuli trigger an immature electroencephalographic (EEG) pattern, "delta-brushes," in the corresponding sensory cortical areas. Whether auditory stimuli evoke delta-brushes in the premature auditory cortex has not been reported. Here, responses to auditory stimuli were studied in 46 premature infants without neurologic risk aged 31 to 38 postmenstrual weeks (PMW) during routine EEG recording. Stimuli consisted of either low-volume technogenic "clicks" near the background noise level of the neonatal care unit, or a human voice at conversational sound level. Stimuli were administrated pseudo-randomly during quiet and active sleep. In another protocol, the cortical response to a composite stimulus ("click" and voice) was manually triggered during EEG hypoactive periods of quiet sleep. Cortical responses were analyzed by event detection, power frequency analysis and stimulus locked averaging. Before 34 PMW, both voice and "click" stimuli evoked cortical responses with similar frequency-power topographic characteristics, namely a temporal negative slow-wave and rapid oscillations similar to spontaneous delta-brushes. Responses to composite stimuli also showed a maximal frequency-power increase in temporal areas before 35 PMW. From 34 PMW the topography of responses in quiet sleep was different for "click" and voice stimuli: responses to "clicks" became diffuse but responses to voice remained limited to temporal areas. After the age of 35 PMW auditory evoked delta-brushes progressively disappeared and were replaced by a low amplitude response in the same location. Our data show that auditory stimuli mimicking ambient sounds efficiently evoke delta-brushes in temporal areas in the premature infant before 35 PMW. Along with findings in other sensory modalities (visual and somatosensory), these findings suggest that sensory driven delta-brushes represent a ubiquitous feature of the human sensory cortex during fetal stages and provide a potential test of functional cortical maturation during fetal development.

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